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ORIGINAL ARTICLE

The Association of Microalbuminuria with Severity of Coronary Artery Disease Detected by Angiography in Type II Diabetes

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ABSTRACT

Background: One of the strongest risk factors for coronary artery disease is diabetes mellitus. Therefore, it is crucial to identify CAD in diabetic patients as soon as feasible. This study aimed to assess the relation between microalbuminuria and the angiographic severity of CAD patients with type 2 DM by SYNTAX I, SYNTAX II and Gensini scores. **Patients and Methods:** The study comprised 82 type II DM patients who were referred for elective coronary angiography due to a suspected CAD. All patients had their urinary albumin-creatinine ratio (UACR) determined, and the Gensini, SYNTAX, and SYNTAX II scores were used to determine how severe each patient's CAD was. **Results:** There were 26 (31.7%) females and 56 (68.3%) males in the study population. They were 56.29 + 9.18 years old on average. According to the UACR level, patients were divided into two groups: group 1 included patients with UACR less than 30 mg/g (41 patients), and group 2 included patients with UACR greater than or equal to 30 mg/g (41 patients). According to the study, patients in group 2 had considerably higher Gensini scores than patients in group 1 (P=0.001) and significantly higher SYNTAX scores than patients in group 1 (P=0.001). Age and the duration of DM and UACR had a positive association (p=0.003), and hypertension (HTN) and the duration of DM and UACR had a positive correlation (p=0.049). **Conclusion:** In type II DM, microalbuminuria can be utilized to predict the presence and severity of CAD.

Keywords: microalbuminuria, coronary artery diseases, diabetes, SYNTAX score, Gensini score.

INTRODUCTION

The most significant complication of diabetes mellitus (DM), a chronic metabolic condition with many other side effects, is cardiovascular disease. A significant cause of death in both industrialized and developing nations is coronary artery disease (CAD).

A complex condition, CAD has a variety of risk factors. The differences in cardiovascular disease incidence and mortality across people are not totally explained by the major and independent risk factors for CAD, such as advanced age, male sex, hypertension, diabetes, and dyslipidemia. As a result, other risk factors have been suggested to help identify people who may be at risk for developing CAD [1].

Homocysteine levels, C-reactive protein, B-type natriuretic peptide, fibrinogen, and other new biomarkers have all been connected to cardiovascular risk. One of these novel biomarkers, microalbuminuria (MA), is now known to be a sign of atherogenesis due to its association with a number of atherosclerotic risk factors and early endothelial damage in the systemic arteries. [2,3]. SYNTAX I, SYNTAX II, and Gensini scores were used to analyze the connection between microalbuminuria and the angiographic severity of CAD patients with type 2 DM.

PATIENTS AND METHODS

In the study, 82 persons with type 2 diabetes took part ,DM was defined as fasting plasma glucose above 126 mg/dl, glucose levels >200 mg/ dl at

any measurement, or active anti-diabetic treatment. From December 2022 to May 2023, the study comprised patients who had been referred to the Catheterization Laboratory of Zagazig University Hospital and Police Hospitals for elective coronary angiography due to a suspected CAD during the study's recruiting period.

Urinary Albumin to Creatinine Ratio (UACR) was used to split patients into two groups: Group I with ACR less than 30 mg/g, and group II: with ACR more than or equal to 30 mg/g.

Patients with suspected CAD who were referred to the Catheterization Laboratory for an elective coronary angiography with type II DM from both genders were included in the study.

Type 1 diabetes, chronic kidney disease, decompensated liver disease, rheumatic valvular heart disease, decompensated heart failure, recent cerebrovascular events (like brain infarction or hemorrhage), significant arrhythmias, and chronic inflammatory diseases were among the study's exclusion criteria.

All enrolled patients were subjected to the following:

Comprehensive investigation of the patient's medical history and clinical examination, with a focus on the DM's duration and management. Systolic blood pressure of at least 140 mmHg, diastolic blood pressure of at least 90 mmHg, and/or the usage of antihypertensive medications were all considered to be indicators of hypertension. [4]. Patients were classified as current smokers if they had smoked during the six months prior to study admission.

Routine laboratory investigations included the following: complete blood count, serum creatinine, HbA1c, prothrombin time, international normalized ratio (INR), lipid profile, C-reactive Protein (CRP), and Erythrocyte Sedimentation Rate (ESR). The estimated glomerular filtration rate of patients was determined using the Mayo Clinic Quadratic equation, which does not underestimate normal GFR as does the Modification of Diet in Renal Disease calculation in diabetics [5].

Routine 12-lead ECG.

Echocardiographic examination:

Transthoracic echocardiography was done for all patients using 2D Echocardiography, the following parameters were measured: Ejection fraction (EF), left ventricular end-systolic and end-diastolic diameters, left atrial and aortic root diameters, and anomalies in segmental wall motion. The American Society of Echocardiography's criteria were followed for all measurements and evaluations. [6].

Measurement of urinary albumin/creatinine ratio:

Before coronary angiography, all patients underwent a timed urine test to quantify the albumin/creatinine ratio (ACR), which was determined using a turbidimetric MA kit. The urine samples were taken in the morning or four hours after the patient's last urination.

Coronary angiography was performed for all patients via femoral approach utilizing the standard technique. Coronary lesion was deemed substantial if there was more than or equal to 50% of vessel diameter stenosis. The severity of CAD was categorized using the SYNTAX score, SYNTAX score II, and Gensini score. The SYNTAX score was generated by a computer program composed of sequential and interactive self-guided questions. [7], The SYNTAX score II, which combines the anatomically based SYNTAX score with clinical characteristics, is used to evaluate the severity and enhance decision-making [8], and Gensini Score by two specialists to measure the degree of stenosis. For a total score of 0 to 32, the eight coronary segments' most severe stenosis was scored from 1 to 4 (1%-49% lumen diameter reduction: 1 point; 50%-74% stenosis, 2 points; 75%-99% stenosis, 3 points; and 100% occlusion, 4 points). This score provides an index of the severity of coronary atherosclerosis by assigning a severity score to each coronary stenosis based on the degree of luminal narrowing and its geographic relevance [9].

Ethical consent

The academic and ethical committee at Zagazig University approved the project. Each patient signed a written informed permission form to participate in the trial. The Declaration of Helsinki, the World Medical Association's code of ethics for studies involving humans, guided the conduct of this work.

STATISTICAL ANALYSIS

The collected data were coded, processed, and analyzed using the SPSS (Statistical Package for Social Sciences) version 22 for Windows® (IBM SPSS Inc., Chicago, IL, USA). For continuous data, categorical variables were expressed as percentages and numbers, whereas mean and SD were utilized for categorical variables. The

Student t-test, the Likelihood ratio 2 test, and the Pearson's test were used to compare continuous variables between groups. The Pearson's test was used to look at correlation. For all two-tailed tests of significance, a P value of 0.05 or lower was considered statistically significant.

RESULTS

The patients were separated into two groups based on the values of the urine albumin-creatinine ratio (UACR): UACR less than 30 mg/g and in group 1 (normoalbuminuric). Group 2 (microalbuminuria) with UACR more than or equal to 30 mg/g and 41 individuals were included. There were 41 patients total.

Table (1) displayed the clinical and demographic information of all research participants.

Table (2) compared clinical and demographic data across groups 1 and 2, and found a significant rise in group 2 Only the duration of DM in group 2 compared to group 1 showed a statistically significant difference between the two groups in terms of various demographic and clinical parameters.

Table (3) There was no statistically significant difference between groups 1 and 2 when comparing the EF assessed by the echocardiograph. There was no statistically significant difference between groups 1 and 2 when GFR was compared between them.

Table (4) indicated a negative Pearson correlation value (r) of -0.379 between the duration of DM and GFR in all patients. an highly significant (p 0.001) relationship was seen between the number of years with DM and GFR.

Table (5) showed There was a statistically significant difference between groups 1 and 2 in terms of the number of vessels affected, with a higher proportion of patients in group 2 having two or more vessels afflicted than in group 1.

Table (6) revealed a comparison of the SYNTAX scores between groups 1 and 2 of CAD patients. The study found that as compared to group 1, group 2's SYNTAX score dramatically improved. showed Gensini score comparison between groups 1 and 2 for patients with CAD. According to the study, group 2's Gensini score significantly increased when compared to group 1's.

Table (7) showed Comparison between group 1 and group 2 regarding SYNTAX II score points for PCI and for CABG in patients with CAD, the study revealed significant increase in SYNTAX II score points for PCI in normoalbuminuric group, and significant increase in SYNTAX II points for CABG in microalbuminuric group.

Table (8) Detailed analysis of risk variables for ACR in multivariate form. Age and the length of the disease were significant risk factors for ACR, with an odds ratio of 3041.244. (p= 0.003). Odds ratio of HTN & DM duration as risk factors for ACR was 0.339 with significant association with ACR value (p= 0.049).

Table (1): Distribution of the patients according to demographic, comorbidities data.

Variables	n (%)
Age (years)	56.29±9.18
Male/female	56/26
HTN	47 (57.31)
Smoking	42 (51.21)
FH of IHD	31 (37.8)
Duration of DM (years)	7.2±4.06
Dyslipidemia	39(47.56)

Table (2) Comparison between group 1 and group 2 regarding basic demographic and clinical parameters.

		Group I: Normoalbuminuric		Group II: Microalbuminuria		P value
Age/ years Mean ± SD		**56.19±8.83**		**56.39± 9.63**		0.924 NS
		Group I: Normoalbuminuric		**Group II: Microalbuminuria**		
		Count	**%**	**Count**	**%**	
Age	**Male**	**32**	**78.1**	**24**	**58.54**	0.058 NS
	Female	**9**	**21.9**	**17**	**41.46**	
		Group I: Normoalbuminuric N=41		**Group II: Microalbuminuria** N=41		
		N	**%**	**N**	**%**	

Hypertension	**22**	**53.6**	**25**	**60.9**	0.503 NS
Smoking	**22**	**53.6**	**20**	**48.7**	0.659 NS
Dyslipidemia	**18**	**43.9**	**21**	**51.2**	0.507 NS
FH of IHD	**9**	**21.9**	**12**	**29.3**	0.447 NS
	Group I: Normoalbuminuric		**Group II: Microalbuminuria**		
Duration of DM	**6.21±3.58**		**8.19±4.31**		**0.027 S**

Table (3): Comparison of Ejection Fraction (EF) and Glomerular Filtration Rate (GFR) among the two group

	Group I Mean±SD	**Group II Mean±SD**	**P value**
EF	**58.63±9.83**	**57.35±9.66**	0.554 NS
GFR	**89.21 ±20.67**	**82.65 ±23.41**	0.182 NS

Table (4): Correlation between duration of DM and GFR.

	GFR	**P value**
Duration of DM by years	**r=0.379**	**0.001 S**

Table (5): Relation between MA and no. of vessels affected among both studied groups.

	Group I	**Group II**	**P value**
Single v.	**29**	**12**	**0.001 S**
Two or more v.	**12**	**29**	

Table (6): Comparison between group 1 and group 2 regarding SYNTAX and Gensini score in patients with CAD.

	Group I Mean±SD	**Group II Mean±SD**	**P value**
SYNTAX I	**12.71±4.80**	**22.46±6.31**	**0.001 S**
Gensini score	**26.19±23.75**	**52.43±33.02**	**0.001 S**

Table (7): Comparison between the studied groups in Syntax II score points:

Variable	**SYNTAX II PCI**		**SYNTAX II CABG**		**t-value**	**P-value**
	mean	**SD±**	**mean**	**SD±**		
Group 1 <30	22.85	5.52	17.78	7.62	4.849	<0.001
Group 2 ≥30	17.79	7.98	28.35	7.12	11.323	<0.001

Table (8): showed Multivariate analyses of risk factors for ACR.

	ACR	
	Odds ratio	**P**
Age & HTN	0.819	0.886
Age & Smoking	1.149	0.927
Age & Dyslipidemia	0.833	0.895
Age & DM duration	3041.2	**0.003**
HTN & Smoking	0.924	0.855
HTN & Dyslipidemia	0.767	0.485
HTN & DM duration	0.339	**0.049**
Smoking & Dyslipidemia	0.935	0.879
Smoking & DM duration	0.374	0.103
dyslipidemia & DM duration	0.362	0.051
HTN, Smoking & Age	1.029	0.985
HTN, Smoking & Dyslipidemia	0.815	0.688
HTN, Smoking & Duration of DM by years	0.304	0.083

DISCUSSION

Cardiovascular disease is the most significant consequence of diabetes mellitus (DM), a chronic metabolic condition. Both in industrialized and emerging nations, CAD is a leading cause of death.

Many studies are looking for novel risk factors to identify people who may be at risk for CAD in addition to the well-known CAD risk factors. Independent of renal function, microalbuminuria (MA), a measure of endothelial and vascular damage, may be a predictor of coronary artery atherosclerosis [10].

In addition, Microalbuminuria belongs to microvascular complications and is modifiable by DM control, while atherosclerotic disease as CAD is a macrovascular complication of DM, and DM control status does not affect it markedly.

Although the link between MA and cardiovascular events is well understood, there have been relatively few studies that have looked at the relationship between angiographic CAD severity and MA. In order to assess the relationship between MA and the existence and severity of CAD in type II diabetes patients, this study looked at both variables.

In our research, we discovered that group 2's (albuminuric) duration of DM was much longer than longer in comparison with group 1 (nonalbuminuric) (8.19±4.3 and 6.2±3.58, respectively, P<0.027). This result was concordant with the result of Ahmed *et al*. [10], who in their study assessed the relationship between MA and severity of CAD detected by coronary angiography on 200 diabetic patients in Sohag University Hospital and reported similar results. However, this result was discordant to the results of El- Awady *et al*. [11], who in their study done at Al Mansoura University Hospital reported no significant difference between microalbuminuric and normoalbuminuric groups regarding duration of DM.

Regarding hypertension, the current study found no statistical correlation between hypertension and MA (P= 0.503). This was in agreement with Hoseini *et al*. [12] However, there is some contradiction between the current study and Sheth *et al*. [13].

Regarding smoking, the current study found no statistical correlation between smoking and MA (P= 0.659). This was in agreement with Deveci *et al*. [14] . However, this was in contradiction to Parsa *et al.* [15]

Regarding family history of IHD, the current study found no statistical correlation between the family history and MA (P= 0.447). This was in agreement with Islam *et al.* [16]

Regarding Dyslipidemia, the current study found no statistical correlation between dyslipidemia and MA and the quantity of vessels impacted (P= 0.507). *This result was concordant with* Aziz *et al.* [17]

There was no statistically significant difference concerning LVEDD, LVESD, LVEF and WMSI which is in accordance with Sadaka *et al.* [18]. These results disagreed with Liu *et al.* [19]

Our study revealed a statistically significant difference in the number of coronary vessels affected between the two groups; also, group 2 had a higher percentage of people with multivessel affection than group 1 did. This outcome is in line with that of Sadaka *et al.* [18], who studied the relationship of MA and angiographic severity of CAD. They discovered a strong correlation between multi vascular disease and MA.

SYNTAX score was used in our study to assess the CAD severity. When compared to patients without MA, it was considerably higher in those with MA (22.46±6.31 and 12.7±4.8, respectively, P<0.001). These results are concordant with the results of Ahmed and colleagues; Elawady and colleagues; and ELsawasany and colleagues, who found also significant association between MA and the severity of CAD as assessed by SYNTAX score [10,11,20].

In our study, there was high Gensini score at the positive urinary ACR group which in agreement with Deveci, *et al.* [21], Luo, *et al.* [22], El Sherif, *et al.* [23]

Bildirici and colleagues, Guo and colleagues, and Parsa and colleagues, also reported more severe CAD in patient with MA; depending on Gensini score to assess the severity of CAD [24,25,15].

Moreover, Rein *et al.* [26], reported that When compared to patients with normoalbuminuria, patients with albuminuria (either microalbuminuria or macroalbuminuria) had a considerably higher rate of coronary artery stenosis of greater than or equal to 50% (P<0.001). Both T2DM patients and patients without T2DM showed a strong correlation with

this.

CONCLUSIONS

Compared to patients without MA, those with MA have more severe and widespread CAD. The inclusion of this straightforward assay in clinical practice may have an impact on how aggressively the disease is managed and, eventually, how it turns out.

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